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VIEWS, NEWS AND INTERVIEWS.

At the present time one-quarter of the output of the central electric generating station at Hamburg, Germany, put up originally for lighting purposes only, is used for working the street railway lines. At Aix-la-Chapelle, also, it is proposed to take current from the lighting station for the same purpose. The lines on which the electric power are to be used aggregate 15 miles in length. The overhead system is to be adopted.

The Christiania, Norway, Telephone Company is adopting the Pulver microphone in place of the Blake. No less than 615 of the latter were replaced last year.

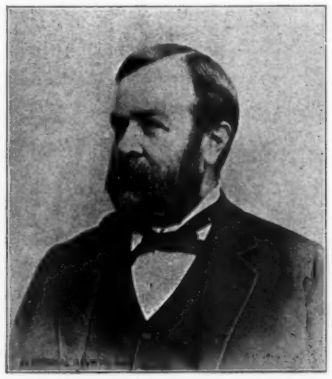
It was, doubtless, a hard pill for the Commissioner of Patents to swallow when he was called upon to award the contract for printing the *Patent Office Gazette* and specifications to the Norris-Peters Company. This was the concern which was crowded out of the contract for the current year by the Kenney-Quincy combination, with the result of saddling the Patent Office with poor work, long and vexatious delays and a full-grown scandal. The old company has bid so far below the new one for the coming year's work that it would have been hard for Mr. Quincy's ingenious mind to devise an excuse for inducing Mr. Seymour to discriminate against it again. It may be, moreover, that Mr. Seymour has by this time learned his little lesson and concluded to charge his former mistake to inexperience and try to do better in the future.

Murderer "Dink" Wilson was successfully executed by electricity at Auburn, N. Y., at 12.41 o'clock on May 14. One thousand six hundred and eighty volts passed through Wilson's body. The current was gradually reduced to 150 volts. At the end of a minute the current was cut off and the physicians were invited to examine the victim. His shirt front was torn away and in the absence of a stethoscope the doctors pressed their ears to the man's breast. No pulsation could be detected, and all united in a verdict of death.

PROF. EDWIN J. HOUSTON RE-ELECTED.

HE WILL FOR THE SECOND TIME SERVE AS PRESIDENT OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Prof. Edwin J. Houston, of Philadelphia, who was last week re-elected president of the American Institute of Electrical Engineers, was born at Alexandria, Va., July 9, 1844. His name is almost universally known in connection with his work as a co-



PROF. EDWIN J. HOUSTON, RE-ELECTED PRESIDENT AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

laborer with Prof. Elihu Thomson in the development of the Thomson-Houston system of electric lighting. He has also taken out numerous patents for electrical inventions made by him individually, and he acts as an electrical expert in patent cases.

In 1884 Professor Houston was made a member of the United States Electrical Commission, and the Franklin Institute chose him as chief electrician of its International Electrical Exhibition. He was for a long time Professor of Natural Philosophy and Physical Geography in the Central High School of Philadelphia, and Professor of Physics in the Franklin Institute. Only a short while ago he resigned his teaching work to form the firm of Houston & Kennelly, electrical experts and engineers. Professor Houston is the author of several works on geography and chemistry, and he has also written "The Telephone," "Primers of Electricity," "A Dictionary of Electrical Words, Terms and Phrases." He is one of the editors of the *Journal* of the Franklin Institute, and frequently reads papers before that body and the American Institute of Electrical Engineers, besides contributing articles on theoretical and applied electricity to the technical journals.

NOTES OF INTEREST.

There will be no monopoly of the running of electric boats on the Erie Canal. Governor Flower has nipped the canal boat trust in the bud.

Judge Donovan has denied the application of the Detroit, Mich., Common Council for a mandamus to compel the public lighting commission to submit its contracts to the council.

A customer of a London electrical firm recently wrote from India for the price of a machine which "(1) gives electrical shocks and sends out sparks; (2) is a magic lantern of sorts; (3) can make any noise desired, and can ventriloquise. The name of the instrument has been forgotten."

An English bacon curing company recently received a suggestion that they should utilize the electric current during the daytime for heating electric branding-irons, which should be used in place of the old-fashioned brands. This suggestion was adopted, and the company are now branding their bacon by this new method, which has given general satisfaction.

Shake 'Em Up!

If the electric door bell refuses to ring, advises some one who knows, shake up the electric jars. If that does not remedy the trouble, put more water in them. It sometimes happens that the water gets so low that the connection is broken and moisture is all that is necessary. Put the water in the jar and shake it up a little.—*New York Times.*

Mr. Vanderbilt's Electric Launch.

The General Electric Launch Company has just sold an electric launch to Cornelius Vanderbilt for use at Newport. It will be equipped with the Consolidated Electric Storage Company's batteries.

THE INSTITUTE MEETING.

TENTH ANNUAL AND GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS HELD AT PHILADELPHIA—VALUABLE PAPERS PRESENTED—PLEASANT SOCIAL FEATURES—THE ATTENDANCE.

The tenth annual and general meeting of the American Institute of Electrical Engineers was held at Philadelphia on May 15, 16, 17 and 18, 1894. The headquarters of the attendants were at the new and palatial Hotel Metropole, while the meetings were held in the comfortable house of the Engineers' Club of Philadelphia, in quaint old Girard street. The social features of the meeting were more than usually pleasant and the committee of arrangements deserves praise for the success of its efforts. The papers presented showed careful preparation and several will, doubtless, prove of considerable value to the profession.

The annual meeting was called to order by President Houston, at 10 A. M. on Tuesday, May 15. He made a brief address and was followed by Mayor Stuart, who delivered the address of welcome. The yearly reports were submitted, and a resolution was adopted memorializing Congress to adopt units agreed upon at the Chicago Electrical Congress. John C. Trautwine, Jr., president of the Engineers' Club, made a brief address. These officers were elected: President, Prof. Edwin J. Houston, Philadelphia; treasurer, George M. Phelps, New York, each for one year. Vice-presidents (for two years), Prof. William A. Anthony, Vineland, N. J.; Francis B. Crocker and James Hamblet, New York. Managers (for three years), A. E. Kennelly, Philadelphia; William D. Weaver, Charles S. Bradley and William B. Vansize, New York.

The afternoon session began at two o'clock and was taken up with the reading and discussion of these papers: "A Review of the Progress of the American Institute of Electrical Engineers," by Prof. Edwin J. Houston; "On the Sub-division and

Distribution of Artificial Sources of Light," by Prof. Wm. A. Anthony.

The reading of the paper on Lightning Arresters, by Mr. Wurts, was postponed and the members concluded the afternoon's meeting by visiting the plant of the Philadelphia Traction Company, at Thirteenth and Mount Vernon streets, where several experimental demonstrations were shown.

On Tuesday evening, from 8.30 to 11 o'clock, an informal and enjoyable reception, under the auspices of the Engineers' Club and the electrical section of the Franklin Institute, was held at the Manufacturers' Club.

At the Wednesday morning session papers entitled "Some Storage Battery Phenomena," by Mr. W. W. Griscom; "Unipolar Dynamos for Electric Light and Power," by Prof. Francis B. Crocker and Mr. C. Howard Parmly and "Alternating Currents and Fuse Wires," by Prof. Dugald C. Jackson and Mr. R. J. Ochsner; "Discriminating Lightning Arresters and Recent Progress in Means for Protection against Lightning," by Alexander Jay Wurts, of Pittsburgh, were read. Mr. Wurts' paper was accompanied by experimental demonstrations, made possible through the courtesy of the Philadelphia Traction Company.

On Wednesday afternoon Prof. R. B. Owens read his paper on "Test of Closed Coil Arc Dynamo" and Alton D. Adams presented "Relative Advantages of Toothed and Smooth Core Armatures." Mr. C. Reginald Van Trump, of Wilmington, Del., was down on the programme to read a paper on "Central Station Economy," but decided to withhold the paper for further elaboration and future presentation.

In the evening the ladies attending the meeting were invited to a theatre party at the Broad Street Theatre, under the escort of Mr. C. A. Bragg, while the gentlemen were attending the annual banquet at the Hotel Metropole. Covers for about 100 were set. Prof. E. J. Houston presided, and very agreeably performed the functions of toastmaster. The responses were brief and often witty. The "Electrical Press" was cared for by George M. Phelps, and Elmer G. Willyoung, the chairman of the committee on arrangements, responded to "The Philadelphia Committee." The other toasts were "Commercial Electrical Engineering," H. Ward Leonard; "Mathematics and Electricity," A. E. Kennelly; "Electrical Engineering Education," Dr. M. I. Pupin; "Electricity and Time," James Hamblet; "Power Transmission," C. F. Scott; "Electricity in the West," Prof. R. B. Owens; "The Electrical Expert," Prof. William A. Anthony.

The papers read on Thursday were, "The Waste of Zinc in Open Circuit Batteries when Standing Idle," by Mr. Henry A. Lardner; "Standardizing Electrical Measuring Instruments: (*a*) by the Potentiometer Method; (*b*) an Improved Direct Reading Potentiometer," by Elmer G. Willyoung; "An Optical Phase Indicator and Synchronizer," by Prof. George S. Moler and Dr. Frederick Bedell; "A New Method of Recording any kind of Variable Current," by Prof. Albert C. Crehore. The meeting adjourned at 12 o'clock in order that the excursions provided by the committee on arrangements might be enjoyed. During the afternoon the visitors and members visited Cramps' ship yard, where members of the company received them, and all the great operations in hand were examined. Then the party proceeded down the river on a steamer and a planked shad dinner was served at Gloucester. At the Manufacturers' Club during the afternoon a committee of ladies entertained the visiting ladies, and a visit was made by coach up the Wissahickon to Indian Rock Hotel, where dinner was served.

The programme for Friday consisted of papers on "Resonance Analysis of Alternating and Polyphase Currents," by Prof. M. I. Pupin; "Some Facts about Polyphase Motors," by Dr. Louis Bell; "The Law of Hysteresis (Part Three), and the Calculation of Ferric Inductances," by Charles Proteus Steinmetz, and "Experiments with Two Phase Motors," by Dr. Louis Duncan.

During the meeting the privileges of the Franklin Institute, the Schuylkill Navy Athletic Club, the Historical Society of Pennsylvania, and the University of Pennsylvania were extended to the visitors, who were also invited to inspect the new power station of the Philadelphia Traction Company, the Edison Electric Light station, factory of the Chloride Accumulator Company, and the plant of the Germantown Electric Light Company (where there is a large storage battery plant). Messrs. Houston & Kennelly very kindly placed their office facilities at the disposal of those attending the meetings.

THE ATTENDANCE.

Luther Stieringer, New York; Winford Levis, Philadelphia; Hermann S. Hering, Baltimore; Nelson W. Perry, New York; Carl Hering, Philadelphia; O. T. Louis, New York; G. G. Grower, Ansonia, Conn.; Henry D. Reed, New York; Arthur Hoopes, Westchester, Pa.; H. T. Farrington, E. R. Keller, Philadelphia; H. M. Davis, New York; E. K. Landis, G. B. Price, Philadelphia; Alfred C. Wiener, Schenectady, N. Y.; E. A. Scott, Philadelphia; Chas. P. Steinmetz, Fred. W. Tischendoerfer, Schenectady, N. Y.; A. A. Knudson, New York; F. R. Upton, Orange, N. J.; Chas. S. Bradley, New York; W. E. Harrington, Camden, N. J.; Fred. Cornell, Frankfort-on-the-Main, Germany; Chas. S. Jaeger, Maywood, N. J.; C. Billberg, E. S. Stuart, Philadelphia; Wm. A. Anthony, Vineland, N. J.; C. A. Bragg, Philadelphia; R. W. Pope, N. D. Webster, New York; W. E. Anderson, Virginia; James Hamblet, Geo. M. Phelps, New York; J. C. Trautwine, Jr., A. E. Childs, W. C. L. Eglin, W. A. Drysdale, Philadelphia; H. S. Chase, New York; F. E. Swoope, Jr., Chas. Hewitt, W. J. Johnston, A. E. Kennelly, Peter Wright, L. K. Perot, Edwin J. Houston, Philadelphia; R. O. Heinrich, Newark, N. J.; R. B. Owens, Lincoln, Neb.; W. E. Culbertson, C. W. Swoope, C. P. Wilson, J. F. Stevens, Phila.; J. W. McCrosky, F. McS. Thomas, Baltimore, Md.; Geo. R. Metcalfe, New York; J. G. Biddle, Phila.; Frederick Bedell, Ithaca, N. Y.; A. J. Rowland, Phila.; J. M. Knox, New York; F. H. Hochrath, P. Uhlenhaut, Jr., Phila.; C. N. Black, Cleveland; E. E. Keller, Pittsburgh; G. H. Harris, Phila.; J. W. Th. Olan, N. Y.; P. G. Gossler, Brooklyn; M. H. Gerry, Jr., St. Paul; W. D. Weaver, New York; Leonard Waldo, Bridgeport, Conn.; S. D. Mott, Passaic, N. J.; A. J. Wurts, Pittsburgh; Stephen L. Coles, ELECTRICAL REVIEW, N. Y.; Franklin Shebler, C. W. Pike, C. R. Arnold, Phila.; W. W. Griscom, Haverford, Pa.; R. McA. Lloyd, Joseph Sachs, New York; Albert Buys, Rutherford; F. B. Corey, Brooklyn; H. Ward Leonard, Cary T. Hutchinson, N. Y.; Gano S. Dunn, F. B. Crocker, W. A. Mosscrop, Wm. R. Hewitt, New York; Thos. Spencer, Philadelphia; F. G. Waterhouse, Hartford, Conn.; Fred. Reckenzaun, Hoboken, N. J.; Richard Pfund, W. B. Lester, New York; W. P. Daltell, H. P. White, Wm. D. Marks, W. I. Cheyney, F. W. Darlington, F. L. Knight, S. G. Flagg, Jr., Philadelphia; John L. Hall, Wilmington, Del.; A. L. Johnston, Philadelphia; Chas. F. Scott, Pittsburgh; H. G. Reist, Schenectady, N. Y.; G. Martin Brill, Philadelphia; J. P. Jackson, State College, Pa.; L. N. Schultz, Philadelphia; T. C. Martin, New York; F. E. Jackson, East Orange, N. J.; John Haskin, J. Paul Gaylord, Philadelphia; W. F. Hanks, New York; A. P. Maycro, J. D. Israel, Philadelphia; J. C. George, Baltimore, Md.; Alfred E. Braddell, Philadelphia; P. R. Moses, L. A. Thayer, Jos. Wetzler, Chas. E. Emery, F. R. Colvin, Harold Binney, W. J. Hammer, New York; Wm. Stanley, Pittsfield, Mass.; R. M. Hunter, Philadelphia; Chas. T. Rittenhouse, New York; Morgan Brooks, Minneapolis; E. A. Colby, Newark, N. J.

REPORT OF COUNCIL FOR THE YEAR ENDING APRIL 30, 1894.

In compliance with the rules of the Institute your council begs leave to submit the following report covering the period since the annual meeting, May 16, 1893:

Ten regular meetings and one special meeting of the council have been held at which the average attendance was nine.

As stated in the report of last year, there has been a desire manifested by the membership for the adoption by the Institute of an official badge and a certificate of membership. Many designs were submitted and the matter was given careful attention by a special committee. Both the badge and certificate were prepared for distribution about the date of the last annual meeting. Your council has also instructed the secretary to print upon all publications of the Institute the emblem thus officially adopted.

In view of the probability of a large number of visitors at the World's Fair and Electrical Congress, who would be glad to avail themselves of office facilities, your council recognized the necessity of establishing at the Electricity Building a suitable rendezvous, which was placed under the direct charge of the secretary. As no fund existed which could be properly drawn upon for this object, it became necessary to issue a call for voluntary subscriptions for this purpose. There was a general and hearty approval of the plan, and as will be seen by the financial report the receipts were $1,148.14. This amount was not quite sufficient to cover the entire expenses which were $1,331.47, leaving a deficit of $183.33. The beneficial results accruing from the carrying out of the plan under the supervision of the Special World's Fair Committee may be learned from their final report submitted February 21, 1894, from which the following is an extract:

> The wisdom of establishing official headquarters at the World's Fair has been conclusively proven, and your committee believes that the Institute may well congratulate itself upon the results achieved. The Institute register shows the memorandum of 612 visitors, among whom were many of the most distinguished electricians of the day. Eighty-one new associate members have been elected this season; 15 come up for election on January 17, and 21 are posted for the February meeting. A total of 117. Although but few meetings have been held this season, this number is already in excess of the increase in membership during the entire years of 1891 and 1892. A large proportion of this increase can be traced directly to the World's Fair headquarters, and without doubt our membership will continue to be largely augmented by the addition of many of those identified with the electrical profession who have been led to appreciate the importance of the Institute through information received at the official headquarters at Chicago.

It may also be stated that the expense of maintaining independent offices was less than would have been necessary had the Institute joined in the maintenance of the general engineering headquarters at Chicago, which would have required an assessment of $2 per member, or a total expenditure of $1,380, with far inferior results.

The record of the preliminary work of the Institute in preparing for the International Electrical Congress of 1893 has been very fully placed before the membership in the printed transactions, and it is satisfactory to know that it was generally appreciated, especially in the deliberations of the Chamber of Delegates. In order to provide for the publication of the proceedings of Congress, an arrangement was entered into between the regularly appointed Publication Committee and your council, by which the Institute has undertaken to secure a sufficient number of subscriptions to guarantee the publication of the Congress records without loss. The limit of 400 subscribers having been reached, the work has been started and it is expected that the book will be issued by September next. Should any surplus accrue from this undertaking it has been recommended by the World's Fair Committee that it be applied to cover the deficit in the World's Fair fund as stated. Owing to the lack of time, several matters were left unfinished by the Congress, some of which were deemed of such importance that a committee has been appointed, of which the president is chairman, to carry on the necessary investigations and report upon a standard of illumination. This matter, which was considered the most important item of incompleted work, is in the hands of various sub-committees, having laboratory facilities at their disposal in various parts of the country, and is under the direct supervision of members of the Institute.

The plan of printing and distributing to the entire membership the advance copies of the papers read before the Institute meetings has been carried out as thoroughly as possible during the year. The distribution of the revised papers with their discussions at the end of the year in a bound volume, has been generally appreciated, and while this plant has added somewhat to the cost of publication, the total expense incurred was less than for the volume of transactions issued for the previous year.

Among other results of the World's Fair year, the increase of membership in Chicago and vicinity led to a desire upon the part of Western members for an opportunity to discuss the various papers brought before the Institute. At the November meeting in New York city a plan was authorized by which upon the petition of 20 members such meetings might be held either simultaneously or following the meeting at which the paper was originally read. Two meetings under this plan have already been held at Chicago, at which the papers read in New York city on March 21 and April 18 were also read by proxy, and discussed. Letters received by the secretary from Western members indicate a hearty approval of the plan and it seems likely that it will become a permanent practice of the Institute, and lead to a most important extension of its influence. Every movement of this kind which has been undertaken with a view to extending the more general knowledge of the work of the Institute seems to lead to a substantial growth of membership.

Without going into the detailed statistics of your affairs during the past 10 years, the following statement is of interest, showing the number of members who have been elected and actually qualified for membership during that period: 1884, 154; 1885, 14; 1886, 11; 1887,

152; 1888, 70; 1889, 113; 1890, 116; 1891, 100; 1892, 96; 1893, 165. Total, 991.

The lesson to be learned from this statement is that there must be yet a large number of electrical engineers who may be expected to become members in the near future, and it has been the policy of your council to maintain the standard of membership in order that such membership become year by year of constantly increasing value. The 10 volumes of transactions already issued form in themselves a very complete record of electrical progress during the life of the Institute. Many of the most important inventions and researches have first been made public under the auspices of this organization.

The total membership at the close of last year's report was 673, classified as follows:

Honorary Members		3
Members		206
Associate Members		464
Total		673
Honorary Members elected during the past year	1	
Associate Members elected	179	
		180
Total		853
Resignations	14	
Deaths	6	
Dropped from the roll on account of non-payment of dues	20	
Elected, but failed to qualify	13	
		53
		800

Leaving a total membership of 800 on April 30 (a net gain of 127), classified as follows:

Honorary Members	3
Members	235
Associate Members	562
	800

The following have died during the year: Dr. James B. Williams, Grosvenor P. Lowrey, Anthony Reckenzaun, Anthony C. White, Dr. F. Schulze-Berge, Dr. Chas. E. Zetzsche.

The reports of the secretary and of the treasurer show in detail the financial affairs of the Institute at the close of the fiscal year; and give as a balance $14.90 and $407.54 respectively. In the Building Fund there is $905.49.

A REVIEW OF THE PROGRESS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

ABSTRACT OF INAUGURAL ADDRESS AT PHILADELPHIA MEETING, MAY 15, 1894, BY EDWIN J. HOUSTON, PH.D.

The American Institute of Electrical Engineers is in no sense a local organization. It represents the electrical profession in all parts of our great land, and welcomes into its membership bright and progressive men in the electrical profession wherever they may be located.

There is, perhaps, at this time, a special fitness that the annual meeting, which witnesses the closing of the first decade of our association, should be held in the city of Brotherly Love, where the Institute had its birth.

At the time of the International Electrical Exhibition, at Philadelphia, in 1884, eight years had elapsed since the Centennial Exhibition of 1876 sowed broadcast the germs of public interest in electricity, and thus laid the foundation for a belief in the brightest promises of the electric future.

Between 1876 and 1884, nearly a decade, the work done in the electrical field was necessarily of a pioneer and independent character. The great principles of the science already discovered and announced were but vaguely understood and needed the practical men to carry them into actual commercial use. To a great extent, each investigator trod the path of discovery alone, gropingly penetrating into the regions of the unknown.

Happily, the International Electrical Exhibition of 1884 brought together the workers in electricity both in this country and, to a certain extent, in other parts of the world, not only during the exhibition itself, but especially during the completion of the buildings and the arrangement of the exhibits. The varied exhibits thus brought together from all sides were a revelation to these hitherto independent workers, and showed them, from what had already been accomplished by electrical science, what might reasonably be expected in the near future. The stimulus so excited culminated in the organization of the distinguished body I now have the honor of addressing.

At the same time the U. S. Government appointed a United States Electrical Commission authorizing it to conduct a National Conference of Electricians in Philadelphia during the progress of the International Electrical Exhibition. The commission determined to appoint as members of this conference not only the college and university professors, whose labors have always proved of such immense value to the world's weal, but also those equally important investigators, the inventor and actual worker in the commercial electrical field.

There was thus convened in 1884, in the city of Philadelphia, a notable gathering of men who had long toiled in the electric field, both in the so-called pure sciences and in the applied sciences.

In this notable assembly of electrical students our American Institute of Electrical Engineers originated. The first step was the circulation in April 1884, by Mr. N. S. Keith of a paper asking for signatures for the purpose of organizing a proposed National Electrical Society. A preliminary meeting was called on April 15, 1884, in the city of New York, at which a series of resolutions were passed, and a committee of organization appointed to call a meeting, which was subsequently held on May 13, 1884, when rules of order were adopted and officers were elected. The first regular meeting of the Institute was held in Philadelphia, October 7 and 8, 1884, in one of the exhibition buildings in West Philadelphia.

From this small beginning our Institute has assumed its present proportions. Its growth was at first uncertain, but its vitality was undoubted, and its present rate of increase is fully equal to that of our English cousin, the Institution of Electrical Engineers. Although the London institution had the start and has the advantage of us in membership, yet I look forward in the near future to a membership in our body that will be fully on a par with theirs.

I think it would be difficult properly to estimate the good that has accrued to electric science, not only in this country but also in the world at large, from a properly organized association of specialists in a practical branch of science like that of electricity.

A glance at the transactions of the Institute will show the extended and valuable character of the work of its members. This work embraces notable inventions, extended commercial applications and valuable researches; as for example, researches in high frequency discharges; the development of alternating current apparatus for electric welding and for the transmission of power; improvements in continuous current apparatus; improvements in the practical applications and control of electric motors for traction, mining, manufacturing and other purposes; improvements in telephony and in telegraphy; improvements in the application of electricity to various chemical processes; improvements in designs for electric machinery; improvements in electric lighting apparatus of various descriptions and developments in electrotherapy.

The work of the Institute as a body has also been of a broad and valuable character. I have already pointed out to you, in my inaugural address of last year, the valuable contribution the Institute made to the Chicago Congress and Exhibition of 1893. Since that time, as you are aware, organized work under the auspices of the Institute has been and is being carried out in different parts of the country, as well as in England, for the completion of some of the work the Chicago Congress was obliged to leave uncompleted; viz., the determination of suitable standards of light and of illumination.

Another action of which I think the Institute may be proud has been its provisional adoption of the well-known names of Gilbert, Oersted, Gauss and Weber, for the most important quantities in the magnetic circuit, thus filling a well defined void in the practical development of the dynamo, motor and magnets generally. These names have already been favorably commented on in Europe, where they have been embodied in at least one standard text-book.

Up to this date there has been much uncertainty as to the meaning which should properly be attached to the very important term "inductance." It was hoped that the Chicago Congress would decide this question, but, as this hope was not realized, the Institute, by appealing to the prominent affiliated institutions in Europe, has been enabled to ascertain the concensus of opinion upon this matter among electrical engineers all over the world, and has to-day adopted the meaning of inductance as a "co-efficient of induction," this being the world's majority verdict, so far as has been possible to obtain it without the aid of an International Congress. It has also adopted the word "reactance" for that quantity in alternating current circuits whose square added to the square of the resistance is the square of the impedance.

It would be ungenerous in me in thus reviewing the causes which have led to the development of electrical science in this country, to fail to mention another potent factor. I refer to the electrical press. I recognize its power and the good it has accomplished in spreading broadcast over the country, not only to the members of the Institute, but to all interested in electrical progress, the knowledge of very great advance made in electric science. The growth of the electrical press has kept pace with the growth of electrical science. In 1876 the power of the press was considerably feeble. The exhibition of 1884 caused, perhaps, as great an increase in the power and influence of the press as it did in the development of the science of electricity itself, and great as has been the marked improvement in electrical science, as demonstrated by the Chicago Congress of 1893, I think close observers will agree with me that such progress has been fully equalled by the wonderful improvement in the electrical press of our country.

Although there are electrical societies in other parts of the world, yet in none of these countries is to be found that organized effort and concentration in one central body of the electricians from all parts of the country as is so markedly seen in the United States, England, France and Germany.

It is, I think, a significant fact, that the countries in which there has been so marked a progress in electrical invention and engineering, are those which possess the advantages of this combined effort on the part of all its electricians. The reason is, I think, evident; under these circumstances, there exists the enthusiasm which comes from properly organized effort; the rapid progress which is encouraged by friendly rivalry and the incentive to increased and continued effort bred of healthy competition.

Among the many advantages of membership in such learned associations, as, for example, the Institute in which we are the most interested, are the following: Concentration of effort; increased mentality, excited by generous rivalry; systematic explorations into the domains of the unknown; a tacit agreement as to what shall be regarded as the standard of good work; the practical establishment of a high court of last resort by whom all disputed technical questions in electrical engineering shall finally be settled; the removal of electric work from the region of guess work to that of certainty, permitting results to be as surely predicted as in other sciences, and consequently, the increased stimulus to the successful investment of capital in electrical enterprises; the reduction of misdirected effort by the promulgation of information concerning what has been attempted or achieved in any direction; and last, but not least, the means of establishing a rapid intercommunication of ideas between different parts of the country to others.

We are naturally and properly proud of the progress shown by our Institute in the first decade of its existence. I ask you now in all seriousness, how has this progress been assured? Clearly by the establishment of a central organized body, as distinguished from separate, independent, and, possibly, antagonistic bodies; by the establishment of a central body which derives authority from a membership extending over the entire country. Partisanship and intelligent scientific work, in the nature of things, have nothing in common. The true scientific instinct is shown in the desire to know the truth for the truth's sake, and the true electrical engineering instinct is to accomplish the best work in the most economical manner possible. To ensure the greatest success—I feel sure you will agree with me—there must of necessity be a central governing body, viz., the council of the Institute, deriving its authority from a membership extending from all over the country, and vested with the power of speaking authoritatively for the Institute between the periods of its recognized official meetings.

In a country like ours, in which distances are so great, a difficulty exists in all our members attending the meetings of a central body, no matter where such meetings might be called. This difficulty is real, and, like all geographical difficulties, cannot readily be solved. I think our association has, however, to a great extent, solved it, by encouraging simultaneous meetings in all parts of the country, where the same paper can be read and discussions had thereon, yet at the same time, holding the governing body, the board of managers, or the council of the Institute, responsible for the proper direction of its work. That all local meetings must be amenable to the organic law of the Institute, be that law what you may choose to make it, I think needs no discussion. I am glad to say that under due authority of the Institute, local meetings have been established in the city of Chicago, and I trust there may soon be other meetings held in all other great centers of population where our membership will warrant it.

RELATIVE ADVANTAGES OF TOOTHED AND SMOOTH CORE ARMATURES.

READ AT THE PHILADELPHIA MEETING AMERICAN INSTITUTE ELECTRICAL ENGINEERS, MAY 16, 1894,

BY ALTON D. ADAMS.

The merits of different methods of construction in the manufacture of dynamo electric machinery, as in other lines, must evidently be decided by their comparative costs, all else being equal. Although questions concerning the relative merits of toothed and smooth core armatures have long been discussed, very little seems to have been written to show whether actual saving in cost may be effected by one construction over the other, when employed to produce the same results.

The practice of dynamo builders in this country and abroad embodies both types, and the history of the art records many changes from each to the other. In view of the above, the inquiry, whether in the light of present facts any saving can be effected by the use of toothed core armatures, seems of interest.

The limits of this paper do not permit consideration of this question in connection with all classes of electrical machinery, and its bearing on direct current constant pressure machines only will be taken up.

The principal disadvantages of toothed compared with smooth core armatures are greater first cost, large change of lead, excessive sparking, when used with too short air gaps, and the production of heat in pole pieces; their advantages are, that inductors are positively driven, large solid inductors, protected from eddy currents, and that a reduction may be made in the length and consequent magnetic resistance of the air gap.

Change of lead may be fixed within any desired limits, and sparking abated by such proportions of air gap and teeth, as give them sufficient magnetic resistance.

Heat in pole pieces may be reduced by their lamination, by the use of very narrow teeth and slots, by forms of teeth that present a nearly continuous surface of iron to the pole pieces, and still more, by the use of openings in core disks which do not cut through their outside surface, or a continuous magnetic sheath outside the teeth.

For any given form of tooth, the heating of pole pieces is less, the longer the air gap.

The mechanical strength of armature teeth, as usually employed, is far in excess of that required to hold inductors in position, even under conditions of short circuit, and driving pins inserted in the core, at proper intervals, are much cheaper and take up less valuable room on the armature circumference.

Either teeth or substantial driving pins are, of course, preferable mechanically to the slender bits of hard fibre which have been much used, and frequently give way under the heavy strains to which large generators are subject.

When large wires or copper rods are used as inductors, their protection from eddy currents is an important matter, but proper stranding of inductors reduces the eddy loss in them, when used on smooth cores, to a very small amount, and has the further important advantage that inductors may be bent into the proper shape at armature ends, and the joints, necessary when rods are used, avoided.

The chief possible advantage, then, to be gained by the use of toothed armatures, is, through a reduction in the length of the air gap and the consequent reduction in the ampere turns required on field magnet, weight of copper, or energy in winding, and the length and weight of iron core. To make this advantage available, it must be practical to use air gaps shorter than are required for insulation, winding and clearance.

As is well understood, the armature winding of a dynamo or motor, in operation, has a magnetizing action which is measured in ampere turns for a bipolar machine, by one-quarter the product of all the inductors of the armature, into the total armature current. The ampere turns on the armature evidently tend to set up a flow of magnetism, having a complete circuit through the armature core, twice across each air gap, and through the iron of pole pieces.

About half the ampere turns furnished by the inductors under pole pieces, evidently act against the field ampere turns in each air gap at the polar tips, and the ratio between the armature and field ampere turns at this point, necessary to give sparkless reversal there, must determine whether the required magnetic resistance be greater or less than that of an air gap long enough for insulation, winding and clearance with a smooth core armature.

As an armature coil in an operating dynamo or motor passes under the brush, the current flowing in it must stop, and one in the opposite direction must be set up; and if this action is to be accomplished without sparking, a sufficient electro-motive force must be provided in the coil while in direct contact with the brush. In the ordinary dynamo or motor, magnetism forced across the path of the coil, by the field ampere turns expended in air gap, must provide this reversing electro-motive force.

The data of a number of smooth core armature machines of different make, show ratios of field to armature ampere turns in air gap, of from about one and one-half to one, to two and one-half to one, and the writer's experience is that a ratio of two to one will give sparkless operation at full load, with brushes set just outside pole corners.

It is a matter of common experience that the ratio between field and armature ampere turns in the air gap may be so reduced, even in machines with smooth core armatures, as to require excessive change of lead to secure even approximate freedom from sparking.

If it be desired therefore to build machines having an expenditure of field ampere turns in the air gap not much greater than those of the armature, we need not resort to toothed cores.

Take, for example, the case of a 260 ampere dynamo, with 120 inductors on its armature in one layer; an air gap induction of 25,000 lines per square inch, and 80 per cent of inductors under the pole pieces.

An air gap of .45 inch between the armature and each pole piece will be sufficient for insulation, winding and clearance, and the field ampere turns expended in each air gap will therefore be 3,500, while the armature ampere turns, active under each pole tip, will be 3,100.

A considerable change of lead and sparking can be readily predicted for this machine.

In some types of small machines the room required by insulation, winding and clearance, makes the air gap longer than necessary for sparkless operation, and in such machines the utility of teeth seems to depend on their cost compared with the saving to be effected by their use.

As the ampere turns, furnished by the inductors under any pole piece, grow less in a machine of given capacity, when the number of poles is increased, very short air gaps may be used, if the number of poles is sufficiently large.

As an increase in the number of poles usually makes a machine of given capacity more expensive, however, the question at once comes up, to what extent the number of poles may be increased without a greater expenditure than the saving of iron and copper to be effected.

In large multipolar machines of four or six poles, such as are commonly used, the length of air gap required for sparkless operation is considerable, and those who have watched the development of these machines with toothed core armatures during the last four or five years, have seen the air gaps gradually widen until machines of this character are not hard to find in which the copper inductors between the teeth could be taken out, wound outside the teeth, and still leave room enough for good clearance.

Additional mechanical security, of course, furnishes a considerable argument for the use of teeth in very large slow speed machines.

A number of devices have been suggested from time to time, to enable toothed core armatures to be used with short air gaps, and the consequent saving in iron and copper effected. No machines with these devices, however, have yet stood the test of time and competition with those of ordinary type, and have yet to prove their ability to produce results, as at present attained at a less cost.

The seeming opportunity to save material by the use of toothed armatures is very attractive, and we cannot but hope it may some day be practical; in the light of present knowledge, however, there seems little to be gained by their use in medium and large bipolar machines.

The Edison Companies of New York and Brooklyn.

Edison Electric Illuminating, of New York, is selling between 101 and 103¼. The bonds are strong around 107. The company's April statement for two years, and for the four months ending April for two years, compared, follows:

APRIL STATEMENT.

	1894.	1893.	Changes.
Gross earnings	$116,210	$102,093	Inc. $14,116
Op. expenses and taxes	49,961	56,153	Dec. 6,192
Net earnings	$66,249	$45,940	Inc. $20,309
Accrued int. bonds	17,966	13,541	Inc. 4,425
Gross earnings, 4 months	488,058	431,058	Inc. 56,999
Net earnings, 4 months	276,275	210,717	Inc. 65,557
Accrued int. bonds, 4 months	63,533	53,833	Inc. 9,699
Incandescent lamps, end. April	200,499	152,918	Inc. 47,581
Arc lamps, end. April	2,637	1,933	Inc. 704
Motors, H. P., end. April	6,384	4,377	Inc. 2,007

Four months, ending April:

	1894.	1893.	Changes.
Gross	$488,058	$431,058	Inc. $56,999
Operating expenses	211,782	229,341	Dec. 8,559
Net	$276,275	$210,717	Inc. $65,577

Edison Electric Illuminating, of Brooklyn, has issued its April statement. It shows very substantial increases, and is regarded as highly satisfactory. The New York Stock Exchange authorized the listing of the $500,000 additional capital stock of this company, to which we referred in a previous report. The statement referred to is as follows:

	1894.	1893.
Gross earnings	$30,335	$25,867
Expenses	16,643	15,491
Net earnings	$13,691	$9,876
Other income	1,416	1,000
Net result	$15,107	$10,876
Less interest on bonds	2,100	2,100
Leaving net amount applied to dividends	$13,007	$8,776

Or 48 per cent. increase.

TELEPHONE NEWS AND COMMENT.

The Erie company has declared a quarterly dividend of $1 per share.

Automatic telephones sound well. Do they do the business? is the question.

Duluth, Minn., is to have a new company to supply it with telephone service.

The American Bell Telephone Company doesn't seem much disturbed over the projected opposition.

A number of Standard underground cables have been placed in Wheeling, W. Va., recently.

A great deal of interest in the new Gilliland Telephone Company is to be observed in telephone circles.

There will soon be telephone exchanges in a number of small cities that never thought they could afford them.

The business of the long distance system is increasing, and the service is becoming more popular with use. This company is well managed.

Up to the time of going to press the rumor that Geo. Gould would head a $20,000,000 telephone company had not been authenticated.

A local telephone company, with a capital of $25,000, has been organized at Beaver, Pa. A new company has also been organized at New Britain, Conn.

The "Twelve Pole" Telephone Company has been organized at Wayne, W. Va. The man with poles to sell should start for this place at once.

The Pennsylvania Telephone Company is making a number of improvements. This company is managed by progressive and experienced telephone men.

The Harrison International Telephone Company is quite active these days. It is getting a good many franchises, and if it has a satisfactory system should do a good business.

Some of these days there will be a big fight between the Western Union Telegraph Company and American Bell Telephone Company. This will be a battle of giants—if it ever does occur.

A syndicate, with Judge Charles Copin at its head, has been organized at Old Orchard for the purpose of erecting a new telephone line between St. Louis and the principal towns in the country around.

A well-known telephone superintendent recently decided to adopt the bicycle as a means of transit. The doctors say he will soon be around

again, although his black eye hangs on a remarkably long time.

Raleigh, N. C., has granted a telephone franchise to the Old Dominion Telephone Company. Look out, Southern Bell!

Thirty-five dollars damages was allowed W. H. Stevens, of Danbury, Conn., because the telephone company put a larger pole in front of his house.

Erie Telegraph and Telephone Company has appropriated $400,000 for extension of its long distance and metallic circuit service and the erection of buildings the coming year.

The increase of telephone companies in the State the past year has been 100 per cent. Last year there was one company, now there are two. The New England and the White Mountain.—*Augusta, Me., Journal.*

The telephone is gradually being more and more adopted in Japan. During February last throughout the country there were 198 applications for connection to the exchanges, the greater part of which were of course in Tokio.

A Pittsburgher has a telephone by which you not only hear but see the man or woman at the other end. This is important, if true, for by the countenance of the talker you can decide whether you are listening to the truth or not.

The telephone exchange at St. Joseph, Mo., was damaged by fire last week. Lightning started the conflagration, it is thought. The switchboard connections were badly burnt, but no great damage was done, and the system was working smoothly again in a few days.

Fort Scott business men want a reduction in telephone rates, and if the Missouri and Kansas Telephone Company does not grant this favor they propose to put in a home telephone system. Col. Pearson says the system can be operated at $1 per month. If that be true, then the telephone monopoly in this country is a whizzer.—*Nevada, Mo., Post.*

A new telephone company, to be known as the Pennsylvania Telephone Company, has been organized at Sonman, Cambria county. It is the intention to have lines all through the State. The first line will be from Johnstown to Ebensburg via Cresson. The following officers have been elected: Dr. G. R. Glass, president; J. J. McDonnell, treasurer; F. H. Young, secretary and general manager.

President John I. Sabin and special agent Louis Glass, of the Sunset Telephone and Telegraph Company, recently appeared before the San Francisco council committee and in eloquent words and figures presented the cause of the company in the matter of telephone rates. It is not likely that the council will change the rates, as the city charter provides that it may.

Charles Smith has begun suit at Allentown against the Pennsylvania Telephone Company for $20,000. Smith had ladies' hair dressing parlors in the building destroyed by fire in that city last October. The fire is alleged to have been caused by the crossing of broken telephone wires with the electric light wires. The company's attorneys claim that the defendant was not responsible for the fire, inasmuch as it was the act of God; and further that the company had introduced every modern device to prevent such an occurrence.

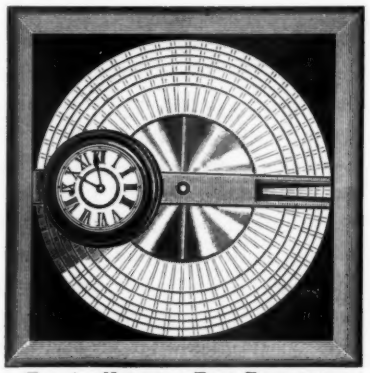


FIG. 1.—NATIONAL TIME RECORDER.

Time Recorder for Electrical Stations.

The New National Time Recorder Company, of Milwaukee, Wis., are putting on the market an autograph recorder for electric light and power stations.

Fig. 1 represents the device, which is 17 inches square. The clock which drives the record-dial is supported in a casting, the ends of which are securely fastened to the wooden frame. The record-dial is secured inside of the frame under lock and key. A small section of the dial is shown in Fig. 2. It is 15 inches in diameter, and when in operation is entirely covered by plate glass, with the exception of an opening on the right hand side, through which the engineer or dynamo-tender can write his signature and also the record desired. By referring to Fig. 2 it will be seen that the record-dial is divided by parallel radial lines into 30 minute spaces so that a record can be made every half hour of the amperes, volts, steam pressure, vacuum, dynamos cut out and dynamos started, which records are separated by concentric lines. The heavy black line is the night line and represents the time from 6 P. M. to 6 A. M. Fig. 2 shows a record made at 5 P. M. by J. Davis, the day man, and a record made at 6.30 P. M. by S. Snow, the night man. These two records are made simply as an illustration. On a dial having been used it should show a record every half hour.

The dials are made to cover a space of 30 hours, so that in case who ever keeps the records does not always change the dials at a certain hour each day, there will be six hours leeway, so that the records cannot be confused.

By an ingenious device in changing the dials each day, the dials are always synchronized with the clock.

By the use of this recorder it is absolutely necessary that the employé should make his record regularly at stated intervals, otherwise that portion of the dial where the record should have been made will have passed on under the glass without the record having been made, showing the employé to have been negligent and that he has not attended to his duty.

The record shows the exact time each dynamo was started and cut out, and the length of time each has been running; also the amperes, from which the average or total day or night load, or both, can be ascertained.

The recorder can be fastened on the wall or laid on a desk, as preferred, as the clock has a marine movement and will run and keep accurate time in either position. This recorder can as easily be adapted to many other kinds of business where a half-hourly or hourly record is desired; the only change necessary being in the printing of the dials.

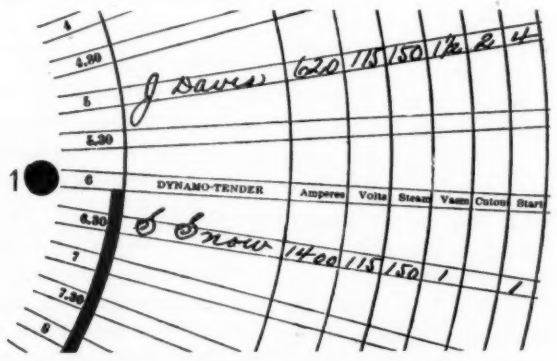


FIG. 2.—SECTION OF DIAL OF NATIONAL TIME RECORDER.

ELECTRIC LIGHT FLASHES.

The village of Fairhaven, Vt., has voted for a tax of $1,700 for the purpose of lighting the streets with electricity. Both arc and incandescent lights will be used.

The Wellsboro, N. Y., Electric Company has purchased the machinery for its plant and expects to be ready to supply light to its patrons about the first of July.

At a special meeting called to vote upon the question of lighting the streets of Geneseo, N. Y., with electricity, the proposition was carried by a vote of 149 for to 74 against.

Middletown, Conn., has pledged a handsome sum towards retaining the Schuyler Electric Works there. The company has paid over $1,000,000 in wages mostly to people in that city.

Chairman Paul Muenzberg of the Special Common Council Committee, of Milwaukee, Wis., has been appointed to obtain estimates of the cost of the establishment of a city electric light system.

At a meeting of the directors of the Hartford, Conn., Electric Light Company D. N. Barney was elected a director and treasurer, and D. P. Colton secretary, filling the vacancies caused by the death of Howard M. Clark. It was voted to increase the capital from $250,000 to $350,000.

Seven bids for a municipal electric lighting plant have been submitted to the special committee of the Springfield, Ill., council. The committee took no action on the bids. They may not make a recommendation to the council for several weeks. The committee consists of Alderman Sayler, chairman; Electrician Shaw, secretary, and Aldermen Rippey, Ball, Southwick and Woodruff.

The contract for lighting the village of Charlotte, N. Y., by electricity has been awarded to Michael Doyle. The electric company is to be known as the Charlotte Light and Power Company. It intends to begin business with a capital of $18,000. An order has been placed with the Westinghouse company for dynamos, and the work of setting poles and putting up wires will be commenced at once.

The Edison Electric Light Company has brought suits in the United States Circuit Court against John F. Betz & Company (Limited), the Manufacturers' Electric Company, the Keystone Watch Case Company, Burnham, Williams & Company, Joseph G. Darlington & Company, and the Bijou Theater, all of Philadelphia, to have the defendants enjoined from using incandescent electric lamps, alleged to be infringements on the Edison patents.

Yellott D. Dechert, as receiver of Joseph Ryan, has an action pending in the Supreme Court to recover $150,000 damages from the Municipal Electric Light Company for having caused a fire which not only destroyed the buildings occupied by Ryan at 1,063 and 1,065 Broadway, Brooklyn, N. Y., but also his entire stock of merchandise. He claims that the fire was due to the improper work on the part of the electric company in fitting up the building with the electrical apparatus in a careless and negligent manner.

The sale of the assets of the Southern Electric Company, of Baltimore, Md., to J. Frank Morrison for $25,000 was ratified by Judge Dennis in an opinion filed in the Circuit Court. Creditors representing $29,000 of the company's indebtedness objected to the sale, which was made by M. N. Packard, trustee. In the opinion Judge Dennis holds that the price obtained was ample under all the circumstances, and that by the sale the creditors of the company will get a larger dividend than they would have obtained in any other way.

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Dangerous $10 counterfeit bills are said to have made their appearance. We hadn't noticed any!

R. R. Sinckler, general manager Barbadoes Telephone Company, Limited, writes from Bridgeton: I derive great information as well as pleasure in reading the ELECTRICAL REVIEW.

Mayor Schieren, of Brooklyn, vetoed the Eastern Telephone Company's franchise. The scheme had too much the appearance of a speculation, and the provisions were too loosely drawn, to suit Brooklyn's common-sense Mayor.

The coal situation is becoming more serious. The strike of the miners is still on with little prospect of an early adjustment. The principal railroads are running short of fuel and several roads have siezed the coal in transit over their lines. Some coal has been imported from Wales and Nova Scotia, but not enough to have any effect in relieving the dearth. Those central stations equipped for burning oil fuel are indeed fortunate at this time.

THE BUSINESS SITUATION.

Our editorial under this head in last week's ELECTRICAL REVIEW seems to have provoked considerable interest in the daily press and in Wall street. We have been asked to quote concrete examples bearing on our general remarks. Take the electric railway field, for instance, which is undoubtedly the branch of electrical work possessing the greatest possibilities for rapid commercial development and consequently offers a constantly growing market for electrical manufactures. Six years ago the price for a complete equipment for a trolley car, including two motors, was about $4,500. This price held for a year and a half and then dropped to $3,850, $3,500 and $3,300, until two years ago it was about $2,850. One year ago $2,000 was the price of the same equipment, greatly improved in quality and efficiency, while to-day the average price is between $1,000 and $1,200. We have been told of an electric railway manager who desired quite recently to purchase an equipment for a single car. He wrote to seven manufacturing companies and immediately was called upon by seven salesmen, all of whom had paid traveling expenses to try for the order. The prices quoted ranged from $1,500 to $640. The manager bought the $640 apparatus.

Here we have a decrease in actual selling prices from $4,500, in 1888, to $640, in 1894, a period of six years. In 1888 there were seven electric railways in the United States. In January, 1890, there were 162 electric railways in operation and in process of construction. In January, 1891, this number had grown to 281, while to-day there are probably over 500 cities in the United States equipped with electric roads, many of them of great mileage, as in Boston, Brooklyn, St. Paul, Minneapolis and Cincinnati.

This marked reduction in the price of railway apparatus during the short period of six years is due largely to competition between manufacturing companies, but chiefly to a reduction in the cost of manufacture, accompanied by an increase in the quality of the product. The margin of profit on the equipment mentioned at $4,500 in 1888 was not as large as it was on a better equipment at $2,850 in 1892, owing to the reduction in the cost of manufacture. While prices have been fearfully cut during the last year by all the manufacturing companies, partly due to intense competition and partly to the business depression, we do not believe that any company can make and sell a satisfactory car equipment for $640 and clear a profit on it. If this sort of thing is kept up, as it probably will be for sometime, we do not see how profits are to be made, granting that the cost of manufacture is at, or near the minimum, unless a wider market than at present exists is developed. We surely cannot hope for a growth during the next six years so marvelous as that between 1888 and 1894, and yet we believe that much can and must be done to widen the field of consumption for electrical apparatus of all kinds, especially railway equipments.

ELECTRICITY IN LIGHTHOUSES.

It has been decided by the Lighthouse Board, at Washington, to install electricity as an illuminant in the lighthouse at Fire Island, New York, and an appropriation of $15,000 has been allowed for that purpose. The authorities of the United States General Lighthouse Depot, at Tompkinsville, N. Y., will soon erect a temporary structure alongside of the present Fire Island light tower, from which will be displayed the present mineral oil light while the electrical apparatus is being fitted in the old tower. The great "bivalve" lens constructed by Lepaute, of Paris, and recently exhibited at the Chicago Fair, will be used with the electrical arc installation. This lens was purchased by the Treasury Department at an expense of $10,000, and sent direct from the World's Fair to the Tompkinsville Depot, where it is at present set up. The term "bivalve" was applied to the lens as its glass parts are in the shape of two huge oyster shells placed face to face in a vertical plane. Specifications will shortly be advertised requesting bids for the electrical parts of the plant.

Fire Island will be the first lighthouse in the United States illuminated by electricity, with the exception of the small beacon on the north point of Sandy Hook, New York Lower Bay, which has been so lighted for some years with current supplied from the electric buoy system of Gedney channel.

Electricity was first used in the United States lighthouse establishment for the supply of these seven buoys and their success was immediate. They have steadily grown in the confidence of mariners, and there has been an enormous increase in the percentage of large vessels using Gedney channel at night by their aid.

We congratulate the Lighthouse Board in thus extending the use of electricity to the Fire Island lighthouse, which may be considered the most important lighted aid for seamen in the United States, as the value of vessels and cargoes safely guided by its friendly rays in a single night may be estimated at millions of dollars. The effective radius of illumination of the light will probably be about 30 miles, and of great intensity.

CORRESPONDENCE.

OUR NEW ENGLAND LETTER.

The Campbell Electrical Supply Co., of this city, have just brought out a new line of Century insulated tape designed expressly for indoor use. Their regular "Century" brand has met with such a pronounced success, and there have been so many demands for a similar article for interior insulation, that the company have felt compelled to meet them, and their new Century has been put on the market with that end in view. Users will find this brand fully covers all their requirements.

The Pittengell-Andrews Company have taken possession of their new and handsome quarters on Federal street, and have now the largest and best equipped supply house in the east. They have just secured the exclusive New England agency for the General Incandescent Arc Lamp Company, of New York, and have now on exhibition the finest line of these goods on the market. They will also have a large display of all sizes of the Lundell motors, which will be connected up and running for the inspection of their customers.

Mr. Henry F. Kellogg, general selling agent of the Whitney Electrical Instrument Co., of this city, leaves Boston on Monday, the 21st, for a five months' trip to the Pacific Coast and way stations. Mr. Kellogg carries with him a full line of the Whitney company's latest instruments, and has a number of good things to present to his many friends which they have not seen before. The trade will do well to be on the watch for him and have their bank accounts in good shape, as he intends to make big holes in some of them, and is well equipped for the undertaking.

The firm of Webster & Brush have just opened a handsome suite of offices in the Hathaway building, 620 Atlantic avenue, and will in the future act in the capacity of manufacturers' agents for all kinds of electrical appliances. At the start they will devote their attention chiefly to railroad work, but expect shortly to branch out into various other lines. Both members of the firm are already well known in the trade, Mr. F. W. Webster having been formerly prominently connected with the purchasing department of the General Electric Company, and Mr. R. H. Brush with the railway supply department of the same concern. Mr. Webster has his headquarters in Boston, and will look after the New England end of the business, while Mr. Brush is located in New York, with offices at 44 Broad street.

Messrs. Almon and Sargent, electrical engineers and contractors of 620 Atlantic avenue, Boston, are doing a good business in several of the specialties for which they have the exclusive agency in this territory. Among these are the well known Belknap motors. Mr. G. H. Almon has just returned from Barre, Vt., at which place he secured the contract for the entire equipment of the stone cutting plant of Murr & Gordon. The current is generated by water power and one 30 horse-power generator and one 25 horse-power motor are located at the source of supply, and the current transmitted a distance of two miles to the stone sheds at the quarries. Here it is used for operating the machinery for running the compressed air drills with which most of the work is turned out. Almon & Sargent are also agents for the L. P. and D. system of power transmission, and have just closed a contract through their New York office for six power transmitters for the North River Electric Light and Power Company of New York, and two for the Pelton Water Wheel Company.

Boston, May 19. H. G. T.

The Institute Meeting.

The tenth annual and general meeting of the American Institute of Electrical Engineers held at Philadelphia last week was scientifically and socially a success. But we think a reform in one particular is urgently necessary. Too much valuable time is taken up in reading papers, leaving little or no time for discussion, which is often more beneficial than the papers themselves. The practice of the American Society of Mechanical Engineers in this respect can be profitably followed by the electrical engineers. The time for the presentation of a paper at a meeting of the Mechanical Engineers is limited to five minutes, or the paper may be presented in a brief abstract. The secretary sends out to all the members a printed set of the papers to be read so that they may familiarize themselves with what they desire to discuss. Where possible, the discussion is written in advance. The electrical engineers could not do better than adopt the same rules. Let's have more practical discussion and less oratory.

Telephone Exchange Fire at Toledo.

A fire which started in the tower of the telephone exchange, Toledo, O., May 10, occasioned probably by crossed wires, totally burned out that institution and seriously damaged other occupants of the block. It is difficult to make an exact estimate of the loss of the company, as it depends upon the damage to the new $30,000 switchboard, which has recently been put in, and the time required to put the exchange in working order again. This is the second fire that the telephone company has sustained recently, as the old switchboard was badly burned by fire on the evening of January 3, last. The combined loss amounts to $20,000.

The sense of humor displayed by the Chicago *Times* in the following remarks is similar to that of a hyena:

When the street railroads replace their horse cars with trolley cars, it will be necessary to add to their outfit of wrecking wagons a few first-class ambulances and hearses, so that the streets may be readily cleared of the dead and dying. They might also establish branch hospitals on the line, and engage rising young surgeons as conductors.

Wall Street and the Electrical Stock Market.

The Wall Street market during the week has been very weak under aggressive bear attacks, and closed on a basis 3 points lower than the opening. Up to Friday it looked as if the bears would have to give up the battle. They had out an enormous short line of stock, and every attempt on their part to cover the same put up quotations. On the day mentioned, however, they succeeded in forcing out a large amount of long stock, with which they covered their lines. The market was somewhat stronger to-day, but hesitating and feverish. The continued delay of Congress on the Tariff issue, the alarming growth of the tramp nuisance, and the exports of gold were the bear features. Trade reports do not show any diminution in the number of strikers or other unemployed, while business continues to be of the hand to mouth order. With the exception of coal and iron prices there has been no appreciation in values.

The electrical stock market was weak in sympathy with the general list. This, however, applied to two stocks which were active, namely General Electric and Western Union. The latter sold down from 85⅛ to 82. Considerable long stock came out and the feeling toward the property was generally bearish. The belief prevails in the Street that the 5 per cent dividend must be reduced, as earnings are gradually falling off in the face of a deficit of over $350,000 for the March quarter.

I am told that there have been further transfers of long distance business between Chicago and New York to the Bell Company's long distance lines, and that there are now only two private wires running between the two cities that are owned by the Western Union. These Bell wires are equipped with telegraph instruments, are secured cheaper than the Western Union wire, and the service is said to be excellent.

General Electric showed further weakness selling down from 36⅝ to 35¼. There was no special news connected with the decline. The feeling was quite bearish owing to the excellent showing made by the Westinghouse report, published by the ELECTRICAL REVIEW last week. Something like $100,000 of the 5 per cent debenture bonds sold at prices between 88 and 89. The advance in these bonds in the face of a decline in stock gave rise to the rumor that the company was quietly buying them up with a view of paying its debt at less than par. Transactions were heavier than they have been for some months.

Edison Electric Illuminating was quiet at 102⅞ to 101. The 5 per cent bonds sold at 107½. North American touched 3⅞ on Friday. The ruling quotation of American Telegraph and Cable is 89⅞.

Westinghouse showed sustained strength, the first preferred being bid at 51½ and held at 52, and the assenting 38 and 38½, respectively. The annual meeting of the company was held in Pittsburgh this week. The old Board of Directors were elected by a vote of 113,000 shares. President Westinghouse stated at the meeting that since the date of the annual report which gave bills payable $560,932, that amount has been reduced so that the amount outstanding was now $380,575. The president stated that the erection of the new works is progressing more rapidly than was anticipated. He said that the iron work of the two principal buildings were up, and that they would be ready to receive the machinery in August.

Erie Telephone weakened somewhat during the week, being bid at 43½ against 45 earlier in the week. The company has appropriated $400,000 for the extension of its long distance metallic circuits and the erection of buildings. Long distance metallic circuits will be constructed in various points in Texas, Arkansas, Minnesota and Dakota. The extension of the system from Winona to Chicago and Stillwater to Duluth is also contemplated. Buildings will be erected at San Antonio and Galveston, Tex., and Cleveland, O.

The Metropolitan Telephone Co., of New York, and the Southern New England Telephone Co. are experimenting in their territory with the system of tolls now used in Buffalo. By this system charges for service are made by the number of calls.

BAIN.

New York, May 19, 1894.

PERSONAL.

Mr. A. O. Tate, until recently private secretary to Thomas A. Edison, has been elected vice-president of the Montana Trust Company, of Helena, Mont.

Mr. J. C. McMynn, the well known electrical and mechanical engineer of the Robert W. Hunt and the Ferris companies, will shortly join the ranks of the benedicts.

Mr. Gilbert M. Smith, well known in the electrical field, has accepted the position of manager of the Manhattan Brass Company. His headquarters will be in New York city.

Mr. R. T. McDonald and Mr. Brainard Rorison, of the Fort Wayne Electric Company, were New York visitors last week. Both of these enterprising gentlemen report a rapid increase in business, particularly in the traction field.

Mr. John MacCormack has severed his relations as agent of the Heine Safety Boiler Company, and has associated himself with the enterprising Stirling Company, manufacturers of the well-known Stirling safety water tube boilers. Mr. MacCormack's offices are at 126 Liberty street, New York city.

George E. Emmons, who succeeded E. W. Rice, Jr., as general manager of the Lynn works of the General Electric Company, is to be sent to Schenectady, N. Y., where he is to have full charge of the plant. Mr. Emmons' place as general manager of the Lynn works is to be taken by electrical engineer J. P. B. Fiske about June 1.

Mr. John H. Noble and Miss Isabella Edelsten have issued cards to their wedding reception at Elizabeth, N. J., for Wednesday evening, May 23. Mr. Noble is one of our brightest young electricians, a valuable member of the able staff of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., and will now be the recipient of the congratulations from a host of friends.

ANTHONY ON DISTRIBUTION OF LIGHT.

ABSTRACT OF PAPER BEFORE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS AT PHILADELPHIA.

Prof. Wm. A. Anthony presented a number of tables and figures, and from these made the following deductions:

An inspection of the table will show that, while a given area may be lighted satisfactorily by 16 clusters of four lamps each, an area one-fourth as large, lighted by four clusters at the same distance apart, would not be as well lighted with six lamps to the cluster. It will be seen also that the larger the area the further apart may lamps of the same candle-power be placed. For example, a room 40 feet square, with 16 lamps 10 feet apart, is fully as well lighted as a room 16 feet square with four lamps eight feet apart.

Let us compare arc and incandescent lights on the same basis, that the minimum illumination shall be the same under both systems. First, I must say that the efficiency of arc lights has been greatly overrated. Instead of being 10 times, it is rarely three times, and often only one and a half times that of an incandescent lamp. This is for the naked arc. For indoor illumination ground or opal globes are nearly always used, and these cut off fully half the light. This leaves the efficiency at the most 1.5 times that of the incandescent lamp. The power required for a 16 candle incandescent lamp is 50 watts, and for a full arc lamp 450 watts. The arc lamp must, therefore, replace nine incandescents. Assuming that the lamps are distributed as described in this paper, the table shows that if four arcs take the place of 36 incandescents, their efficiency as compared with the incandescents must be 1.823, and with the relative efficiency of only 1.5, the arc lamps would not light the space as well as the incandescents. If 16 arcs take the place of 144 incandescents, the ratio of the efficiencies required is 1.56, and arcs at 1.5 are still not equal to the incandescents. If 64 arcs take the place of 576 incandescents, the ratio of the efficiencies becomes 1.42, and arcs at 1.5 would be an improvement on the incandescents. It comes then to this, that unless the area to be lighted is so large as to require about 500 incandescent lamps distributed uniformly over it, the use of full arc lamps requiring the same power, will leave some parts of the area less brilliantly lighted.

If we could make small arc lamps of the same efficiency as the full arc —by full arc I mean the so-called 2,000 candle lamp consuming about 450 watts—we could improve somewhat upon the result as obtained above. But the fact that the mechanism of a small arc lamp costs just as much as that of a large one, and that each small arc will require as much care and attention as a large one, would place a limit upon the subdivision of the arc even if the efficiency could be maintained. And here I wish to enter a protest against the assumption that I often find in discussions on this subject, that the so-called 1,200 and 2,000 candle-power arc lamps are 1,200 and 2,000 candle lamps. There is no 450 watt arc lamp in use that will measure 2,000 candles in the direction of greatest intensity, and compared with other artificial sources for general illumination that is measured as other sources are measured, there is no 450 watt lamp that will give, when surrounded by a plain glass globe, 500 candles.

In a linear distribution, as in street lighting, the arc is at a still greater disadvantage. Remembering that nine 16 candle incandescent lamps can be run with the power required for one 450 watt arc, it is seen that the arcs must be nine times as far apart as incandescents consuming the same power, and to give the same minimum illumination must be 81 times as intense, or about 1,300 candle power. But in no arc lamp, as used for street lighting, do the rays proceeding toward the most distant points to be illuminated, reach more than one-fourth this intensity. In my way of thinking, the location of arc lamps at intervals of 1,000 to 1,600 feet as they are often seen in pretentious country villages and suburban places is an entire waste of money. A little spot 50 to 100 feet in diameter under each lamp is brilliantly lighted, while the more distant points are in darkness all the more profound from the loss of sensitiveness of the eye when in the strong light. Incandescent lamps at intervals of 100 to 200 feet, which could be run by the same power, would give a far better illumination.

Of course, in deciding between the use of arc and incandescent lamps in any special case, there are other questions to be considered besides that of the power required to operate. Practical questions of installation may outweigh all others. The considerations of these is foreign to this paper. The question I have considered is purely one of efficiency, and in treating that question I have assumed that every part of a space to be lighted needs the same amount of light. I have omitted from the consideration all effects of reflection from ceilings, walls or reflectors purposely provided, as these are too various and depend too much upon the conditions in each special case to be introduced into a general discussion. My main object has been to point out to just what extent the general illumination of a space is affected, other things being equal, by the use of large in the place of small sources, using in the aggregate the same power, and I trust the figures and illustrations I have given may be found useful in considering the special cases that may arise.

Proposed Union of European Incandescent Lamp Manufacturers.

It had been foreseen and foretold that the inevitable consequence of the lapse of the Edison incandescent lamp patents would be the flooding of the markets with cheap lamps, says the London *Electrical Review*. There are only two instances of monopolies secured by patents for electrical contrivances being so scrupulously and successfully enforced, and foreign competition being so strictly excluded from the English market, and these are the telephone and the incandescent lamp. It was but natural that the holders of these two patents should keep up the prices of the two contrivances to the highest possible value, and to some extent they were justified in this course, because they had to fight many a costly battle to maintain the validity of their patents, and, in the case of the incandescent lamps, were only able to pay a fair dividend during the last five or six years.

Well founded as these expectations turned out to be, the reality far exceeded all predictions, especially as far as the incandescent lamp was concerned. From all quarters of the globe glow lamps poured into the country, good, bad and indifferent, the bad ones predominating, of all sizes and shapes, of high and low candle power, of voltage varying from two to 150, or more. And, of course, as the lamps were poured in, down went their price; within less than six weeks of the lapse of the Edison patent foreign incandescent lamps were sold in London at 7*d.* a piece, for which the Edison-Swan Company had charged 3*s.* 9*d.* Underselling the market, doing your competitor, became the watchword of the glow lamp trade, and nowhere was this practice carried to greater length than in England. Now, without entering upon the question of the cost of production of an incandescent lamp, it stands to reason that such a state of affairs could only result in the long run in the deterioration of a most important article of consumption, and the utter demoralization and ruin of the trade, and we hail with the greatest satisfaction an item of news which has just reached us from Germany.

A union is being formed with its seat at Berlin, and to which all the influential glow lamp manufacturers of Germany, Austria, Belgium and Holland have already given their adhesion, for putting a stop to the disgraceful cutting down of prices in the glow lamp trade. An organizing committee of three of the most influential lamp makers has been formed, and a general meeting will be called on June 16 of this year at Berlin. It is said that there is not the least intention on the part of the union of maintaining the price of glow lamps at anything like the old rate; in fact the price fixed will be found to be below one shilling; the task of the union simply is to secure to the public a reliable article at a moderate cost, and to the manufacturer a fair profit realized by legitimate transactions.

Sir David Salomons's New Experiments.

The following is a brief description of Sir David Salomons's exhibit at the Royal Society soirée. These experiments illustrate certain new phenomena, or phenomena which are believed to be new, in connection with vacuum tubes. The experiments are shown with tubes containing exhausted air and the current employed is an alternate one. Many of the phenomena require to be shown with very minute currents. In consequence of this method of working, it is probable that many of the effects now observed have been overlooked in the past. These experiments are to be repeated with intermittent direct current and with tubes containing various gases, etc. Although to some extent these have already been carried out, they have not been published up to the present time, the experiments not being completed. The results now to be described are, therefore, limited to the alternate current. The chief phenomena are briefly summed up by the London *Electrical Review* as follows:

1. In a large open tube bands are not formed throughout the length; but when small, this is the case. As the current is increased, the bands appear to be repelled from the center towards the electrodes until the bands disappear. But, if the current be made exceedingly small, until the tube is dark, on placing the hand on the outside of the tube, thus making it into a condenser, the current will pass through the tube, the tube will light up and bands will be produced.

2. If a short rod is supported in the center of the tube and along its axis, these effects can be produced in a more marked manner.

3. Two bright bands are formed on either side of the disk, and these bands are reproduced throughout the length of the free tube the same distance apart as the bands on each side of the disk.

4. A little rod suitably placed at one end of a tube will have bright bands produced at either end, and these bands will be repeated throughout the tube the same distance apart.

5. Contractions, or pierced screens, or any equivalent arrangements, will produce the same effect as the little rod, the regulation being produced by the length of the contraction in one case, and by the distance of the pierced screen from the electrode in the other case, and so on.

6. If the tubes are curved the effects are the same. If a small tube has bulbs blown upon it throughout its length, bands will be formed only in the tube and not in the bulbs.

7. The "sticking" effect of the bands to the glass is shown in a sphere very clearly. A considerable amount of current has to be passed before any of the bands will leave the sides of the glass and take a position parallel to the equator of the sphere; the other bands appearing parabolic in section.

8. Professor Crooke's radiant matter tubes will give the same effects when a very minute current is passed.

9. By altering the amount of current in a suitably arranged tube, it can be shown that, in general, the bright and dark bands are illusory, and that in reality the bright bands become so wide that they overlap; and these overlaps, appearing double as bright as the other portions of the bands, give the impression that these are the bright bands, whereas they are the true positions of the dark bands.

10. If, instead of the electrodes in the above cases inductive arrangements are employed, the same results follow.

LITERARY.

Archibald Forbes, the veteran English war correspondent, contributes to the June *Scribner* a paper on "The Future of the Wounded in War," in which he predicts that the great efficiency of modern weapons and the immense armies which will be brought into conflict will make the condition of the wounded very much worse than it has ever been in modern war—so inhuman, in fact, that it will lead to the final abolishment of war by civilized nations.

OUR BOSTON LETTER.

Marblehead is to have an electric light plant. The site has been selected, and building will commence shortly.

The Marlboro Electric Street Railway Company will extend their line to Hudson this summer, and have already voted to increase the capital stock for the purpose of carrying on the work.

The National Telephone Company, of this city, is rapidly developing into an important factor in the telephone field. Their instruments are claimed to be the best yet put on the market, and are certainly meeting with immediate approval. One of the strongest arguments in their favor is that they are selling instruments, not stock.

The Campbell Electrical Supply Company are more than proud of their installation of La Roche alternators at the central station of the Quincy Electric Light and Power Company, of Quincy, Mass. They invite the inspection of these machines by all prospective users of alternating current apparatus, and are convinced that their showing here will prove a thorough demonstration of their merits.

Rumors are daily gathering strength that it will only be a short time before the immense works of the old Thomson-Houston Co., at Lynn, will be entirely abandoned, and the business of the company handled altogether from Schenectady. These rumors are, of course, denied by the authorities at Lynn, but in spite of this the impression is steadily gaining ground that such is the ultimate intention of those in control, and that the end may come sooner than was expected. Several important changes are contemplated in the near future. The general feeling of uncertainty among the employees is manifested by the fact that they refuse to renew the leases on their homes, not knowing how soon they may have to leave them. Real estate values have declined considerably in consequence, particularly in West Lynn, where the larger part of the hands are congregated.

H. G. T.

Boston, May 21.

The Walker Manufacturing Company's Electric Railway Motor.

The Walker Manufacturing Company, of Cleveland, O., which has long been known as a manufacturer of cable railway plants and heavy machinery for special purposes, has prepared a line of electric railway generators and motors, which it is now ready to supply to the public. The generators are for both direct and alternating currents of any capacity, from 150 to 5,000 horse-power, with an electro-motive force varying from 500 to 10,000 volts; and the motors are for both direct and alternating current work.

These new machines—both generators and motors—are constructed for street railway use, ordinary power transmission, mining, and a special line in which are anticipated large developments in the near future, extra large alternating machines for long distance transmission of power.

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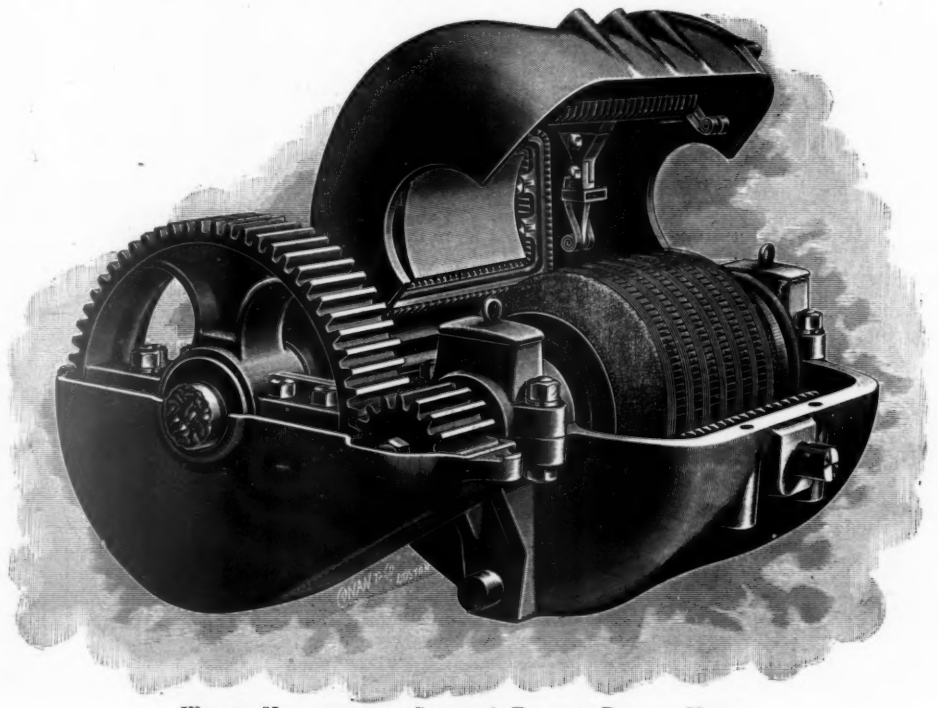


WALKER MANUFACTURING COMPANY'S ELECTRIC RAILWAY MOTOR.

a 35 horse-power cast iron motor for heavy work. It weighs 2,500 pounds. This motor is intended for heavy street railway work where very large cars or trains of cars are used. It is claimed to have an efficiency of nearly 90 per cent. It is built on the same general type as the Walker company's steel motor, but is not spring mounted, being journaled on the axle like all other makes. This motor is exceedingly small and light for its output, being of about the same weight as other makes of 25 horse-power capacity. It will operate on 30 inch wheels with plenty of clearance. The designs are already completed for large motors to operate elevated trains or suburban and interurban railways, which will be run at high rates of speed.

"The Washington street car companies," says Miss Kate Field, "which insist upon putting five people on the seat of an open car, should arrange with the maker of the human frame for certain uniformity of size. If this seems impracticable, they might let little people ride for four cents, and charge heavier ones five, six or seven, as the case might be."

ELECTRIC RAILWAY NOTES.

The sale of the Attleboro, Mass., electric road is again postponed to June 7.

The work of overhauling the machinery of the Union Electric Railway Company's power-house at Saratoga Springs, N. Y,, has begun.

Cars over the Piedmont cable road at Oakland, Cal., are running as far as Mountain View Cemetery by electricity.

A double track electric road from Buffalo to Niagara Falls is in contemplation. It is said that the Pennsylvania Railroad is behind the scheme.

Judge Nethaway has purchased the Stillwater, Minn., street railway and its franchise at public auction for $69,254.27, the amount of its indebtedness.

A company has been organized to build an electric railway from West Newburgh, N. Y., to Orange Lake. It is expected that cars will be running by August 1.

The Overland Electric Railway at Nashville, Tenn., has been sold by order of the court subject to $100,000 first mortgage bonds, for $10,433. R. W. Hunter was the purchaser.

The Cataract Construction Company has begun the work of securing the right of way for a proposed new line, to be used as an auxiliary line for the transmission of electrical power to Buffalo.

The bill to authorize the Lynn and Boston Railroad Company to lease the Boston and Revere Electric Street Railway Company and to increase its capital stock has been ordered to a third reading.

In compliance with the requirements of certain ordinances granting valuable rights to the Scranton, Pa., Traction Company, Mayor Connell has revoked the same for the reason that the company had not complied with specific conditions of the several grants.

Judge Bank has rendered his decision in the sale of the Keokuk, Ia., street railway property to J. C. Hubinger, by overruling all motions to set aside the sale, confirming it and ordering the balance of the purchase money, $8,000, be paid into court by Mr. Hubinger.

The Delaware County and Philadelphia Electric Railway Company has put its trolley road at Chester, Pa., in operation. By the first of July it is expected that the road will be completed to Swarthmore and eventually it will extend to Media.

The People's Traction Company, of Philadelphia, in addition to trolleying its various lines and branches, is to rebuild and reconstruct its several depots to accommodate the new cars. New buildings are to be erected at certain points and existing structures are to undergo extensive alterations.

The Third and Fifth avenue trolley lines in Brooklyn are the popular ones for carrying people to Buffalo Bill's great Wild West show in South Brooklyn. These two roads will undoubtedly do a greatly increased business this Summer, because of this magnificently attractive entertainment.

The Kansas City Elevated Railway has passed into the hands of the Metropolitan Street Railway Company. The Metropolitan company acquired its influence over the "L" road by securing a majority of its bonds. The company was stocked at $2,600,000 and bonded for a like amount. This gives the Metropolitan a monopoly between Wyandotte and Kansas City.

It is reported that a company has been organized to build an electric railway between Pittsburgh and Akron, Ohio. The Street Railway Company, of Akron, Kent, Youngstown and other towns on the proposed line will become members of the new company, which is to have a working capital of $3,000,000. General Samuel Thomas, of New York, and Senator Calvin S. Brice, of Ohio, are said to be heavy stockholders.

William Berg, a 16-year old St. Louis boy met an instantaneous death by electricity in front of his home. He had just finished his dinner and going out on the street took a coil of thin wire from his pocket, tied a stone to one end of it, and pitched it over a trolley wire in front of the house. As it descended he caught the wire-wrapped stone in his left hand, and, as the other end of the wire was coiled around his right arm, the circuit was completed.

United States District Attorney Ingham, of Philadelphia, has filed a petition in the United States Circuit Court, under instructions from the Secretary of War and Attorney-General, for the condemnation of a strip of land in Cumberland township now occupied by the Gettysburg Electric Railway Company. This action was taken upon a report of the United States Gettysburg Battlefield Commission, which has decided to exercise the right of eminent domain on certain portions of the land proposed to be used as the route of the trolley.

TEST OF A CLOSED COIL ARC DYNAMO.

ABSTRACT OF A PAPER READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, PHILADELPHIA, MAY 16, 1894. BY ROBERT B. OWENS AND C. A. SKINNER.

The immediate object of the present paper is to show something of the nature of the armature reactions which occur in arc light machines of the closed coil type, maintaining constant current by automatically shifting the brushes to correspond with changes in load in the external circuit, and to point out certain alterations in design which it is believed may be adopted with advantage. Of course, there are other well known methods of maintaining the current constant. Such machines are now taking a prominent part in the arc lighting industry, and their prominence merits for them more close study.

The machine on which the following experiments were made is a No. 6 25-light 2,000 candle-power Wood arc dynamo. Its designer, Mr. James J. Wood, most courteously consenting to my giving the name of the machine tested and its full data.

The winding data and other details as furnished by the makers are as follows:

The field magnet winding is composed of four coils of No. 10 B. and S. gauge copper wire single cotton covered. The outside diameter when insulated is 0.114 inches. Each coil contains 100 pounds of wire in 15 layers of 74 turns each.

The insulation of the magnet cores is one-eight inch thick and composed of one layer of enameled cloth, the enameled surface facing the iron, the remainder being composed of pressboard 0.025 inches thick. The magnet heads are wooden washers, five-sixteenth inch thick, carefully dried and shellaced.

The armature core is composed of No. 10 B. and S. gauge annealed charcoal iron wire. This is wound on a former which is removable, and is composed of 15 layers, six and three-quarter inches wide. These wires are held together by interposed strips of linen tape. The core is then insulated with a layer of asbestos paper, three thickness of pressboard 0.15 inch thick one layer of asbestos paper again, and then over this one more layer of pressboard 0.15 inch thick, making a smooth surface for the copper wires to be wound on. The insulations near the spider arms are built up of the same material and in the same manner as the armature core until they attain a thickness of one-quarter inch. The armature is wound with 100 sections of No. 14 B. and S. gauge double covered cotton wire. Each section is composed of 93 feet, or 57 turns per section, making a total of 115 pounds of wire.

The regulator magnet is wound with No. 11 single cotton covered B. and S. gauge wire, in the manner shown on the dynamo. The insulation of the cores being five-thirty-seconds of an inch thick, and that of the magnet heads three-sixteenths of an inch. Speed of dynamo, 1,000 revolutions per minute.

The dynamo was securely bolted to a firm foundation of masonry, and driven through a seven inch belt by a small 8x10 inch high-speed automatic engine making 250 revolutions per minute. Steam was supplied at as nearly constant pressure as possible. The automatic regulator of the dynamo was removed, together with one pair of opposite collecting brushes, and the remaining pair reduced one-half in width parallel to the commutator bars, to allow of easier manipulation of the exploring brushes, their angular width being of course adjusted for each load to prevent sparking.

It was at first attempted to use a number of arc lamps as load for the dynamo, but though carefully adjusted and using cored carbons, the variations of potential and current due to their feeding was greater than could be admitted, so the lamps were discarded for two water rheostats 4 foot × 1 foot × 1 foot, with carbon electrodes. These latter on the whole were found to work quite satisfactory, their resistance was not considerably less than when cold, but it changed so gradually that no trouble was experienced in correcting it by adjusting the electrodes.

The distribution of the induction entering the armature at different loads was obtained by taking the electro-motive force at various points on the commutator between two small pilot brushes moved around and in contact with it.

The two brush method though somewhat more difficult to work than the single brush method, has the advantage over the latter of giving the quantities sought directly, instead of as a difference between quantities which are large as compared with those desired. In some cases the integral readings of the brush method have been plotted, but curves so obtained do not indicate so clearly what is mainly sought, namely, the distribution of lines of force entering the armature. True, one curve can be approximately obtained from the other if electro-static instruments are used, but not with electro-magnetic instruments, for they will give only a mean electro-motive force depending on the relative width of a commutator bar and insulation and distance apart of the pilot brushes. The results obtained, however, with a voltmeter of the Weston type are proportional and for the present purpose are equally valuable.

The exploring brushes as finally used were pieces of steel watch springs firmly held in small fibre holders. These in turn were rigidly secured by brass studs to a graduated sliding ring, moving within another stationary ring, attached to and insulated from the dynamo frame and carefully centered with the commutator.

Two brushes were used in each holder to better insure good contact. Copper, brass and phosphor-bronze exploring brushes were tried at first but found as satisfactory as steel. It was also found very necessary at all times to keep the brushes and commutator as clean as possible.

The sliding ring was marked off into 100 divisions, the number of commutator segments, and the exploring brushes made to cover just two commutator bars or one-fiftieth of the circumference, but the ring might have been divided into degrees if desired.

Fifteen sets of readings, 50 readings per set, were taken around the commutator with currents in armature and field of 8, 10 and 12 amperes, at positions of the collecting brushes approximately corresponding to loads of 5, 10, 15, 20 and 25 lights. Three sets of readings were also taken with currents in the field of 8, 10 and 12 amperes and no current in the armature.

The total induction in armature varies very slightly with lead and the displacement of the neutral plane decreases with lead angle, but varies less than 10 degrees from no load to the maximum load used.

On a developed diagram the electromotive forces between collecting brushes would be proportional to the difference between the whole area of curve on one side of the line of commutation and the area of the curve included in the angle of lead, the lead angle being defined as the angular advance of the collecting brushes from the neutral plane. Of course a machine of the design tested with extended pole tips requires an automatic widening of the brush with increased load or independent control of sparking, but it would seem that the waste field at all loads would be less and its weight efficiency greater or cost for a given output less than if its pole tips were cut away. Cutting away the pole tips or at least not extending them would have the advantage of allowing the use of collecting brushes of constant width within a certain range, but whether this advantage more than compensates for the decreased range of its output is open to question. Further experimental evidence is, however, needed in this regard.

Regarding the relative amounts of iron in field and armature, we see no reason for the present practice for using so little iron in the armature, as compared with the field. The necessity of a very high field induction or a thoroughly stiff field is apparent; but why, when the lines are once generated by the field, it is not sought to collect and utilize them all by means of an armature, with a generous amount of iron, is not so easily seen. The number of commutator segments would, of course, have to be increased to prevent sparking, but the regulating qualities of the machine would, it is believed, be impaired. The result would be a larger output and greater efficiency.

Regarding the rates of ampere turns on armature and field, such ratio will depend largely on the shape of the pole pieces and desired width of brush, but is in all cases much less than in constant potential machines. That in the present instance, with the widths of brushes given, the ratio could not be widely departed from without violent sparking.

From what we have seen of the machine it is evident that it would never pay to run machines of this type underloaded. If a number are used in one station the connections of the external circuits at the switchboard should be so manipulated as to keep the machines actually in use always loaded to as near their full capacity as possible.

GENERAL NOTES.

Toledo, Ohio, has granted a telephone franchise to the Harrison people.

Henry W. Pope, one of the early telephone men, is now president of the Mutual Telephone Exchange and Construction Company of New York.

The reorganization of the Oshkosh, Wis., Electric Light and Power Company is now assured, nearly all the creditors having agreed to the proposition.

The Burlington, Cedar Rapids and Northern Railway at Estherville, Ia., have completed a system of supplying the switch signals with electric light from their plant.

The Massachusetts House has engrossed the bill to incorporate the Drawbaugh Telephone and Telegraph Company, with an authorized capital of not less than $1,000,000 nor more than $10,000,000.

Discriminating Lightning Arresters and Recent Progress in Means for Protection Against Lightning.

ABSTRACT OF A PAPER READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, PHILADELPHIA, MAY 15, 1894. BY ALEXANDER JAY WURTS.

The author, after a lengthy description of the Wurts lightning arrester, which has already been illustrated in the ELECTRICAL REVIEW, told of numerous practical experiments and experiences with the device, all going to show its complete success. He said that the Wurts non-arcing railway lightning arrester is eminently suited for the protection of direct current circuits up to 1,000 volts. On 1,000-volt alternating current circuits from smooth body armatures it also operates satisfactorily, but on similar circuits from toothed body armatures the arresters break down after a few discharges, and a short-circuit is established. However, it is not impossible that two or three of these arresters might not be used to good advantage in series on circuits of high potential.

The especial advantages of this arrester were summed up as follows:

1. It offers a direct and non-inductive path to earth.

2. It is absolutely non-arcing and consequently requires no attention after being once properly installed.

3. It has no moving parts and there is nothing about it to get out of order.

4. It is small and, therefore, easily installed under a car.

5. It is cheap and can, therefore, be used in large numbers on the line, on the cars and in the station.

6. Its non-arcing property avoids danger from fire, which property also ensures the non-interruption of the system due to blowing of fuses and constant throwing of the circuit-breakers.

7. Its simplicity and reliability will commend it to every one.

In his closing remarks Mr. Wurts said he wished to answer the now old and oft repeated question "How many, and what kind of arresters would you advise us to use on our line?" as follows: The proper number of line arresters is that number which will prevent discharges from entering the station. Station arresters, if used at all, would be installed with the one idea of providing a final opportunity for discharge, but as the tendency to discharge occurs on the line often several miles away from the station, a sufficient opportunity should be provided *there* where the tendency to discharge originates, and in this manner advantage may be taken of the large inductive resistance afforded by the circuits leading back to the station. If discharges enter the station it is a sure indication that they have done so for lack of sufficient opportunity to discharge from the line—for lack of a sufficient number of line arresters.

It is well to protect dynamos with lightning arresters—it is better to avoid the necessity of this protection by discharging the line.

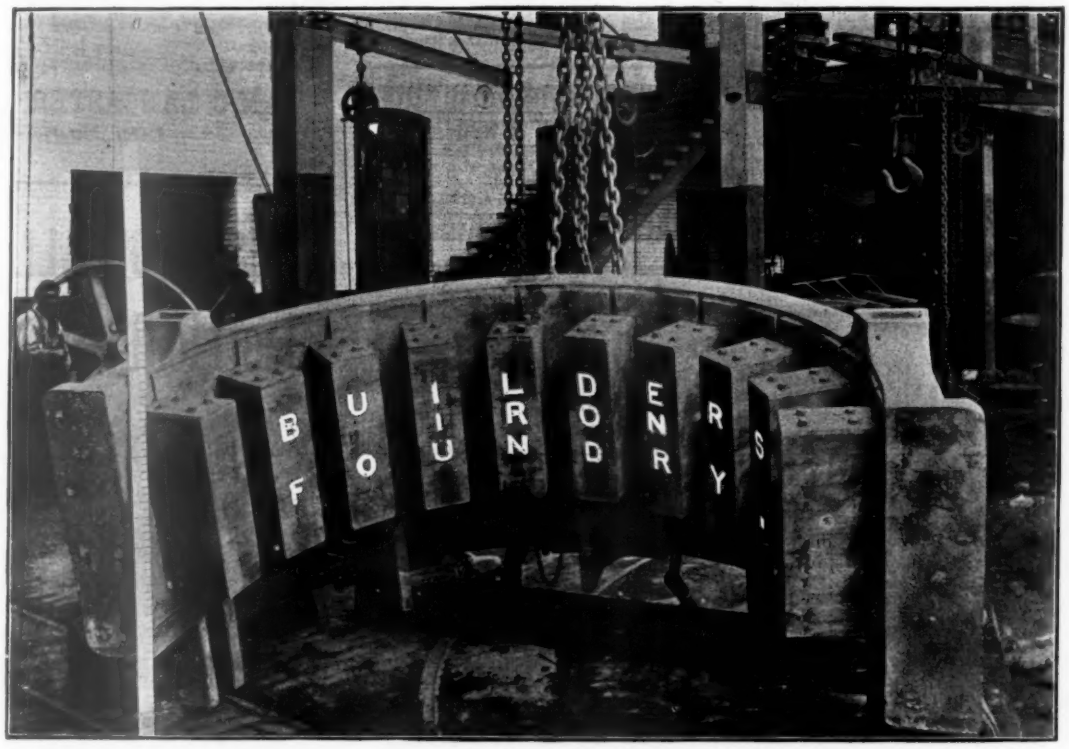
It is even well to use a lightning arrester having a circuit interrupting attachment. It is better to avoid the necessity of a circuit interrupting attachment by using a non-arcing arrester.

Electric Railway Strike in Brooklyn.

Last Sunday there were 40 miles of electric railway in Brooklyn, N. Y., belonging to the Atlantic avenue railway system, tied up because of a strike of 175 motormen and 175 conductors. The company asked the men to buy new Summer uniforms consisting of a Norfolk jacket and a yachting cap of white duck. The men were asked to pay 90 cents each for the caps, $11.75 for the conductors uniform and $5.75 for the motormen's coat. The men refused to be dudes on a salary of two dollars a day. At this writing it is thought that the strike may extend to all the trolley lines in Brooklyn.

A Large Casting.

The casting illustrated on this page is one-half of one of the General Electric Company's 450,000 watts alternating dynamos, and is quite a difficult piece to make, as the ten laminated wrought iron pole pieces have to be cast in, and it is essential that they be absolutely united with the cast iron and very accurately spaced. The casting was made by the Builders Iron Foundry, of Providence, R. I., which gives special attention to large or heavy castings or to those requiring unusual strength or excellence of finish. The capacity of this firm's foundry cranes is 25 tons each.



A Large Casting Made by the Builders Iron Foundry, Providence, R. I.

It is reported that the telephone licensees of the American Bell are at work on a plan to adjust the service to a toll system. This will make those who constantly use the telephone pay their proportionate share of the expenses, while those who only employ the telephone occasionally will reap the benefit. Under the present arrangement a subscriber who is almost constantly calling the office, gets the instruments as cheaply as the one who perhaps does not use the telephone a dozen times in a month.

OUR CHICAGO LETTER.

Mr. Joseph Nahm of the American Lamp Company, of St. Louis, Mo., is a Chicago visitor this week.

The plant of the Fort Madison (Iowa) Water and Light Company may be sold to satisfy claims.

Mr. James I. Ayer was a Chicago visitor this week and enjoyed the wintry breezes blowing in from Lake Michigan.

Captain McCullough, the street railway king of St. Louis, is enjoying the balmy breezes of the windy city this week.

Mr. J. R. Chapman has arrived in Chicago and taken charge of the electrical department of the North and West side lines.

Captain Willard L. Candee and W. H. Hodgins, of the Okonite company, New York, were guests of Mr. George McKinlock this week.

Mr. W. S. Monroe, formerly on Mr. Burnham's staff at the World's Fair, leaves for New York this week on a combined pleasure and business trip.

Mr. J. H. Cooke, of the Buckeye Lamp Company, is kept busy supplying customers with lamps from the Chicago office and reports collections good.

Mr. Allen R. Foote, manager of the National Statistical Association, was in Chicago this week arranging for the publication of certain important papers.

S. Dana Greene and Superintendent Rice made a flying trip from Schenectady to Chicago to consult with Mr. Sunny relative to a large contract offered the company.

Mr. Ernest Hoefer, well-known to the electrical supply trade, is not the individual bearing the same name who shuffled off this mortal coil by the suicidal route last week.

Mr. W. L. Arnold, manager of the St. Louis office of the General Electric Company, has secured an order for a 10,000 light alternator, a larger alternating machine than the company has yet built.

Funerals and street cars.—An old ordinance has been revived forbidding funeral processions in Lake View from passing along any street but North Clark street. The value to street car lines of an ordinance of this character as a time-saver is obvious.

Mr. Archibald J. Robertson, the inventor of the Robertson insulated conduit system, 1612 Monadnock block, is arranging with Mr. J. Luttrell Murphy, of New York, to place his system in operation.

An ordinance has been passed directing elevated railways to place and maintain electric lights at all street intersections beneath the roadway. Failure to comply is punishable by a fine of from $10 to $100 for each offense, and a further fine of $5 for each day the lights are not in operation.

C. L. Bonney, vice-president of the Chicago General Street Railway Company, 1032 Lawndale avenue, invites outline drawings and general specifications of a model plant for the immediate use of 20 motor cars and 20 trail cars, with suitable construction to increase capacity to 40 motor cars, as occasion may require.

Bishop Fallows presided at a meeting held at the People's Institute to consider the feasibility of establishing a school of practical electricity. Prof. John P. Barrett heartily supported the proposed plan, which provides for 45 lessons a year, the cost to the student being $12.50. Classes will be formed this coming week.

Mr. Will Hine is sending out some attractive circulars calling attention to the lasting qualities of Habirshaw insulation, the simplicity, durability and effectiveness of the W-W lightning arrester, and to the superiority of the Wirt dynamo brush for certain types of dynamos, generators, exciters and motors.

Mr. J. B. Wallace has returned to Chicago from a flying trip to Ansonia and New York and brings back excellent news regarding business prospects. In any event, the amount of street railway construction planned in Cook county alone is sufficient to keep one supply house busy, should it receive orders for the material and supplies.

The Windermere Hotel.—Electrical supply dealers must have felt disgusted with the turn of affairs that resulted in the sale of the furniture and establishment of this noted hotel for a total of $38,625, a sum that hardly equals a third of the original investment for furniture. The hotel proper is owned by the Imperial Hotel Company. It was the assets of the A. C. Mills Company that was sold.

Mr. J. H. Rhotehamel dropped in on some Chicago friends quite unexpectedly this week. It was supposed that with his bride he was still sojourning in the land of fruits and flowers. But it appears that the demand of business shortened his trip and he returned to St. Louis a week ago. He states that while business is in a quiet state in the far West, the outlook for a decided increase over the usual Fall trade is very good.

Mr. F. L. Underwood, the elevated railroad promoter, has little faith in the future value of the securities of surface street railways, considered as legitimate investments, but believes that a single mile of an elevated road represents a plant more valuable than fifty horse car lines, and that the worth of its bonds is based on a tangible, legitimate investment. He believes that the "L" roads are as yet in their infancy, but their day of power is rapidly approaching.

The committee appointed by the Mayor to devise a plan for disposing of the overhead wires south of Thirty-ninth street has made its report, which provides for not more than two lines of poles on any one street. As far as practicable low voltage circuits will be carried on one side and high voltages on the opposite side of the street. To the company having first erected its poles belongs the right of way, and all other companies will use their poles and pay rental for same.

Telephones and the Supply Trade.—Is a telephone a specialty that a supply house can handle to advantage? is the question that several companies are asking. Supply companies secure but little trade from the local telephone companies, save in articles which they manufacture. Two Chicago houses have taken out the manufacture and sale of telephones, and now a third is considering the feasibility of doing likewise. In the opinion of the writer, Punch's famous advice is serviceable in this case.

Mr. Marcus Pollasky is pushing his scheme for the construction of an elevated railroad, which provides for municipal participation in the profits and for the ultimate ownership of the road by the city, the investor securing his profit in the interest paid on the construction bonds. Mr. Pollasky claims that his road can be built for $550,000 a mile, the interest thus being reduced to about $30,000 a mile, while the Alley "L" pays interest at the rate of $60,000 a mile and the "L" road at $42,000 a mile.

Prof. J. P. Barrett has returned from a pleasure trip to the Pacific coast and the Midwinter fair, taken principally in the hope of benefiting the health of Mrs. Barrett. But the outing proved beneficial to the professor as well, as the healthy wholesome color in his face clearly indicates. While in the west several committees asked for suggestions on the best plan of utilizing small waterfalls, in canons adjacent to towns, to transmit electricity for lighting and power purposes, and there is little doubt but that several new plants will be installed as the result of Mr. Barrett's visit. Referring to the Midwinter fair he praised the electrical exhibits, which, aside from the exhibits of the different counties in California, are the features of the exposition. The display of the Western Electric Company, the Standard Electric Company and the other companies is very creditable and deserving of much praise.

F. De L.

Chicago, May 19.

The Peru Electric Manufacturing Company, Peru, Ind., are extensively pushing their Leclede carbon batteries and No. 2 Hercules battery.

The Connecticut Pipe Manufacturing Company, of New Haven, Conn., manufactures an underground wire system that is meeting with great favor.

The American Electrical Works, of Providence, R. I., are very busy with trolley line work. Other departments of this large wire manufacturing company are also increasing the output in response to new orders.

The Stirling Company reports an increased demand for water tube safety boilers. Notwithstanding the caution which everyone is exercising in the matter of outlay, the Stirling boiler is meeting with a large sale.

Diehl & Company, of New York, are finding a ready market for their electric fans. The warm weather will soon be warmer, and the man who desires to be comfortable should now arrange for his electric fan.

The Eastern Electric Cable Company, of Hampshire street, Boston, is meeting with continued and increased success in sales of its "Clark" wire. This company quietly and successfully handles a large business.

The Butler Hard Rubber Company brought suit against the city of Newark, N. J., for damages to water rights by damming the Peaquannock River, which was decided on May 17 in favor of plaintiffs, who were awarded $72,899.16.

Harold Binney, patent attorney, 38 Park Row, New York, has arranged to be at the law offices of Lincoln L. Eyre, 927 Chestnut street, Philadelphia, on the first and third Mondays of each month for the convenience of his clients in the vicinity of Philadelphia.

The Clonbrock Steam Boiler Works, of Brooklyn, N. Y., have received a number of flattering endorsements of their "Morrin" steam generator. They claim it is the best boiler ever invented, and evidently have a number of customers who agree with them.

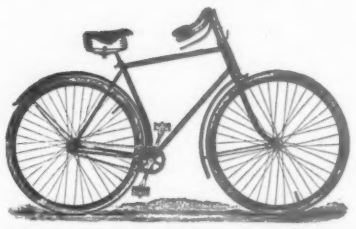
The Garvin Machine Company, of New York, is doing a large business supplying machinery to the electrical factories of the country. This house has an enviable reputation for quality and quantity of goods. A special circular and price-list will be sent on application.

The Central Electric Company, Chicago, is now well settled in its new and commodious offices at 173-175 Adams street. This is probably the largest electrical supply house in the United States, and carries so complete a stock that customers can always promptly secure everything they order.

Chas. A. Schieren & Company, 47 Ferry street, New York, have received an order for 75 feet of 34 inch double perforated electric belt from the Metropolitan Street Railway Company, San Francisco, Cal. This company state that they have tried different kinds of belting and give the electric perforated a decided preference.

The Abendroth & Root Manufacturing Company, 28 Cliff street, New York city, has issued for gratuitous distribution some finely illustrated industrial literature presenting a fund of valuable facts regarding water tube steam boilers in general and the improved Root water tube boiler in particular. Write for their "Information Pamphlet No. 3."

The General Electric Company reports the following orders for railway apparatus taken during the past week from the New York office alone: Brooklyn, Queens County and Surburban Company, 450 motors; Bridgeport, Conn., Traction Company, 60 motors and generators; Danbury, Conn., Street Railway Company, 20 motors; New Haven, Conn., Street Railway Company, 20 motors and generators; Hartford, Conn., Street Railway Company, eight motors; Allegheny Traction Company, Pittsburgh, Pa., 30 motors and generators; Jacob Rich, San Jose, Company, two equipments and generators; W. B. Ferguson, Boston, generator; Franklin, Pa., six motors; Electric Traction Company and People's Traction Company, Philadelphia, Pa., large marble railway station switchboards.



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